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RECENTLY DISCOVERED HOT SPRINGS IN ARKANSAS

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Though the hot springs at the city of Hot Springs, Garland County, Arkansas, probably have been known since the time of De Soto, the existence of other thermal springs within the state was not even surmised until February, 1908. At that time, a man named J. M. Davis, who was then living in or near the town of Caddo Gap, Montgomery County, discovered other thermal springs issuing from the bed of Caddo Creek in the gap where this stream cuts through Caddo Mountain. This gap is 31 miles west, and 10 miles south of Hot Springs.

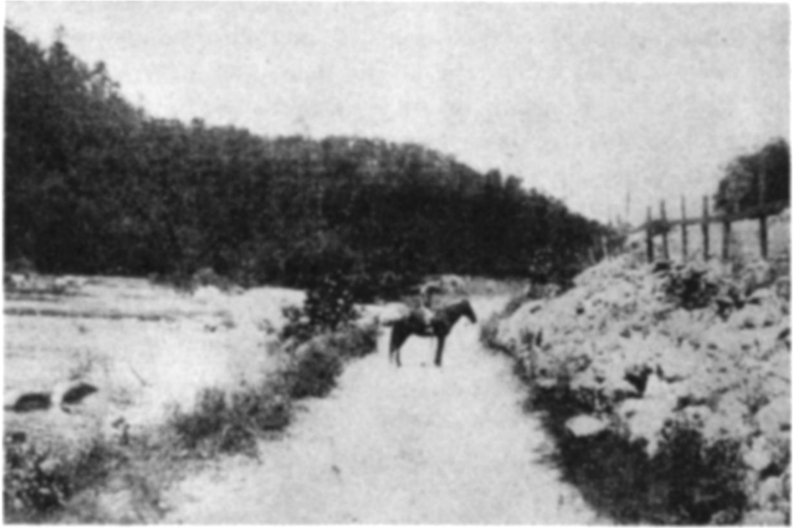

FIG. 1.—Caddo Gap, from the south

As the region about the gap is densely settled, as there has for many years been a small town within a half mile of it, as it is traversed by a wagon road, and as the stream at usual stage is easily forded where the springs issue, it seems remarkable that they did not attract the attention of someone long ago.

Caddo Mountain is one of the numerous east-west ridges that constitute the Ouachita Mountains of west-central Arkansas. Its height in the vicinity of the gap is 1,250 feet above sea-level, and 600 feet above the stream level. As with all the other ridges of the area, the rocks of this one have been disturbed by folding, and, in addition to the folding, they have been faulted at the gap; and like most of the other ridges, including the one from which the springs of Hot Springs issue, the rocks are of the siliceous type known as novaculite.

At Caddo Gap, the rocks are on edge, and strike north 80 degrees east, across the stream. They are here intersected by a thrust fault, as shown in Fig. 2, with an east-west strike.

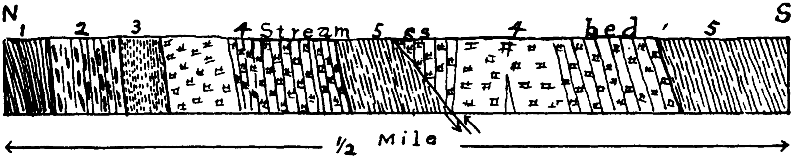

FIG. 2.—Showing the geological section and the rock structure at Caddo Gap. Also, the location of the thermal springs. 5, Stanley shale (Carboniferous); 4. Arkansas novaculite (age undetermined); 3, Missouri Mountain slate (age undetermined); 2, Bigfork chert (Ordovician); 1, Polk Creek shale (Ordovician); *ss*, Thermal springs.

Two springs are known, and their waters rise between the vertical beds of novaculite. Possibly there are others that have not yet been detected. At the time of discovery, all the water of the springs issued below the stream level, but the points of emergence have in part been closed with cement, so that some of the water now issues from the west bank of the creek. For convenience, the springs are here spoken of as the north and the south spring. The surface of the north spring stands about 15 inches and that of the south spring about 10 inches above the surface of the creek at average stage.

The north spring is about 40 feet south of the fault, and the south one 25 feet farther. The temperatures of the two springs, on July 2, 1910, as determined with a physician's thermometer, were 95 degrees and 96.5 degrees respectively. Doubtless the temperature is much reduced by the water of the creek and if so it varies with the seasons. The rock layers between which the water issues are quite warm to the touch beneath the surface of the stream. From a rough determination, the flow of each spring was calculated as 5 gallons per minute. A small bathhouse has been improvised, into which water from the south spring is pumped by hand.

A sample of the water from each spring was taken by the writer and sent to Dr. W. M. Bruce, chemist of the Arkansas Experiment Station at Fayetteville, for analyses. These analyses and the average analysis of seven of the springs at Hot Springs are recalculated and the results given in the following table:

	CADDO GAP THERMAL SPRINGS		AVERAGE OF SEVEN SPRINGS AT HOT SPRINGS
	South Spring	North Spring	
Constituents	Parts per 100,000[*]	Parts per 100,000[*]	Parts per 100,000[†]
SiO_2	1.5600	1.8700	4.4450
$Fe_2O_3+Al_2O_3$	0.7000	0.7200	......
K	0.0000	0.0000	0.1934
Na	0.7526	0.3349	0.4421
Ca	3.8876	4.1680	4.9370
Mg	0.2166	0.4235	0.5621
Fe	......	......	0.0317
Cl	0.4848	0.7138	0.2819
CO_3	6.8265	6.7085	8.8034
SO_4	0.1419	0.2313	0.7689
Total	14.5700	15.1700	20.4655
Free CO_2	2.0000	1.6000	......
Grains per U.S. gallon	8.44	8.79	11.88

[*] Recalculated from analyses by Dr. W. M. Bruce, who gives the constituents as if in (hypothetical) combination; except SiO_2 and $Al_2O_3+Fe_2O_3$. In the recalculation, results were carried out to the fourth place of decimals in order properly to distribute the constituents.

[†] Recalculated from data given in *Ann. Rep., Geol. Surv. of Ark.* (1891), I, 19, where constituents are hypothetically combined, and are stated in grains per U.S. gallon.

The similarity of the analyses is striking, but this would be expected in water flowing through the same formations, as these do. It will be noticed, however, that the water of the springs at Caddo Gap somewhat excels in purity the springs at Hot Springs, which are themselves very pure.

To the geologist, of course, the interesting thing in connection with these springs, as with the longer-known ones at Hot Springs, is the possible source of the heat. Is this due to (1) chemical reactions within the rocks through which the water flows, or (2) accumulated heat from friction, or (3) the presence of hot igneous rocks beneath the surface, or (4) the breaking down or other action of radium along the underground course of the water?

The unusual purity of the water seems conclusive evidence against the first hypothesis. Granted that heat from friction can be so accumulated as to bring the rocks to a high temperature, there is no evidence of recent crustal movement within the region where the springs occur. The location of the springs is doubtless due in large measure to the fault, but this probably was formed at the time of the folding, and if there ever was any localized heat accompanying the crustal movements, it would be expected to have been dispersed long ago. Dr. J. C. Branner, many years ago, stated that the temperature of the waters at Hot Springs is probably due to their coming in contact with masses of hot rocks.[1] In support of this, there are outcropping igneous dykes in and near the city of Hot Springs, and igneous areas of some extent only a few miles distant. While there are no known igneous rocks in the immediate vicinity of Caddo Gap, there are small outcrops in the vicinity of Crystal Springs 18 miles to the northeast, and a small igneous area near the town of Murfreesboro, 22 miles to the south. All these igneous outcrops are of Cretaceous or post-Cretaceous age. So it seems not out of the possibilities that the temperature of the water at Caddo Gap is due to its flowing over hot igneous rocks. Whether or not the radium hypothesis has any value probably could be determined by testing the water for unusual radio-activity. This has not been done.

[1] *Ann. Rep., Geol. Surv. of Ark.* (1891), I, 10.